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PALÆOLOXODON ANTIQUUS ITALICUS SP. NOV., FINAL STAGE IN THE 'ELEPHAS ANTIQUUS' PHYLUM

BY HENRY FAIRFIELD OSBORN[1]

A flood of light on the anatomy and relationships of the 'ancient' or 'straight-tusked' elephant known as '*Elephas antiquus*' has resulted from the discovery in 1911–12 of the skeleton of Upnor and of the skull and jaws of Pignataro Interamna near Cassino, Italy, herein described as *Palæoloxodon antiquus italicus.* The skeleton of Upnor, under the subspecific name *Elephas antiquus* (*andrewsi?*), was excavated in 1915 and finally restored and reconstructed in the British Museum in 1927 under the direction of Dr. Charles W. Andrews and Mr. C. Forster Cooper.

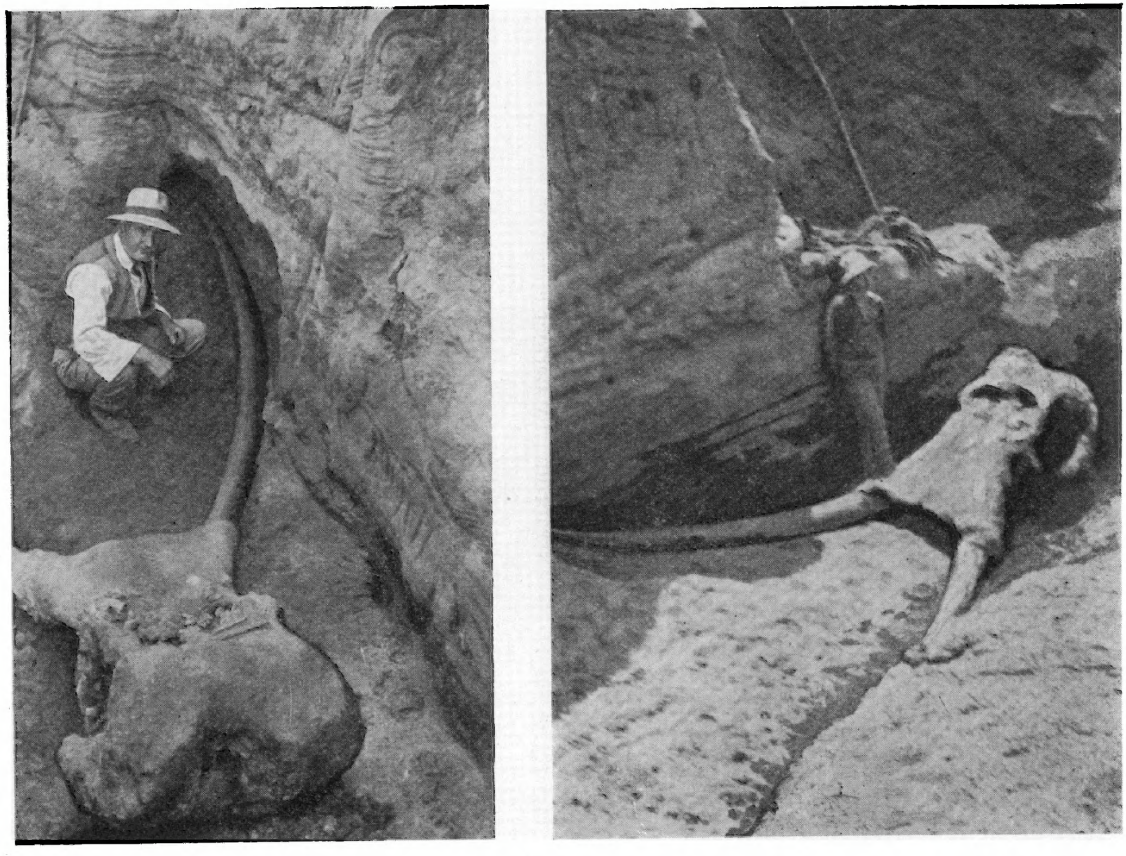
The cranium and jaws of Pignataro Interamna were discovered in July, 1926, and exposed by a farmer, Saverio Tiseo, while excavating for building purposes, in the extraordinarily perfect condition shown in figure 1 and most fortunately reported to Professor Giuseppe De Lorenzo, Director of the Institute of Geology of the University of Naples and a member of the R. Accademia Nazionale dei Lincei. Professor De Lorenzo promptly made a preliminary communication[2] on this most important discovery, and in the following year (1927) published, with the coöperation of Professor Geremia D'Erasmo, also of the University of Naples, a superb memoir entitled "L'Elephas antiquus nell' Italia Meridionale."[3] This memoir (pp. 1–35) affords a most valuable review of the discoveries previously made in the valley of the river Liri (see Fig. 3) in the following localities:

Castelliri	Casalvieri	Isoletta
Arpino	Roccasecca	Pontecorvo
Fregellae	Cassino (grotto)	PIGNATARO INTERAMNA
Ceprano	Aquino	Caianello

[1]This is the author's twenty-second communication on the evolution and classification of the Proboscidea since 1918, and the thirty-second in his total list of papers on the Proboscidea since 1907. See the author's chronologic and classified Bibliography to the end of the year 1929, namely, "Fifty-two Years of Research," pp. 3-54, 74–124.

[2]De Lorenzo, Giuseppe, 1926. "L'Elephas antiquus di Pignataro Interamna in Valle del Liri." Rend. R. Accad. Naz. dei Lincei, Classe di Sci., Fis., Matem. e Nat., Vol. IV, Ser. 6ª, 2° Sem., Fasc. 5–6. Rome.

[3]De Lorenzo, Giuseppe, and D'Erasmo, Geremia, 1927. "L'Elephas antiquus nell'Italia Meridionale." Mem. Atti R. Accad. Sci., Fis., e Matem. di Napoli, Vol. XVII, Ser. 2ª, N. 11.



THE PIGNATARO INTERAMNA CRANIUM OF PALÆOLOXODON ANTIQUUS ITALICUS IN THE AMERICAN MUSEUM OF NATURAL HISTORY (AMER. MUS. 22634)

Fig. 1. Cranium *in situ* of *Palæoloxodon antiquus italicus* as found and exposed by Saverio Tiseo at Pignataro Interamna, near Cassino, Italy, and measured and described by Giuseppe De Lorenzo in 1926 and 1927.

ORIGINAL DISCOVERY AND DESCRIPTION

On pages 35 to 39 (see also Tav. I) of the De Lorenzo and D'Erasmo Memoir of 1927 is given a complete description of this superb cranium in its original state (as cited in full from De Lorenzo's original contribution of 1926, pp. 185–188), of which there is here presented a literal translation[1]:

In the past month of July [1926], the farmer Saverio Tiseo, of Pignataro Interamna near Cassino, excavating, for building purposes, a piece of ground on his farm situated on the southern slope of the hill which borders the village and is really in Fontanarosa, found, at a depth of about 8 metres, a large cranium of a mammifer. This immediately became the object of great curiosity and talk, being announced in newspapers all over Italy as the fossil remains of a large Miocene mastodont.

UPPER MIDDLE PLEISTOCENE HORIZON OF PAL. ANTIQUUS ITALICUS
Compare figure 3 for details

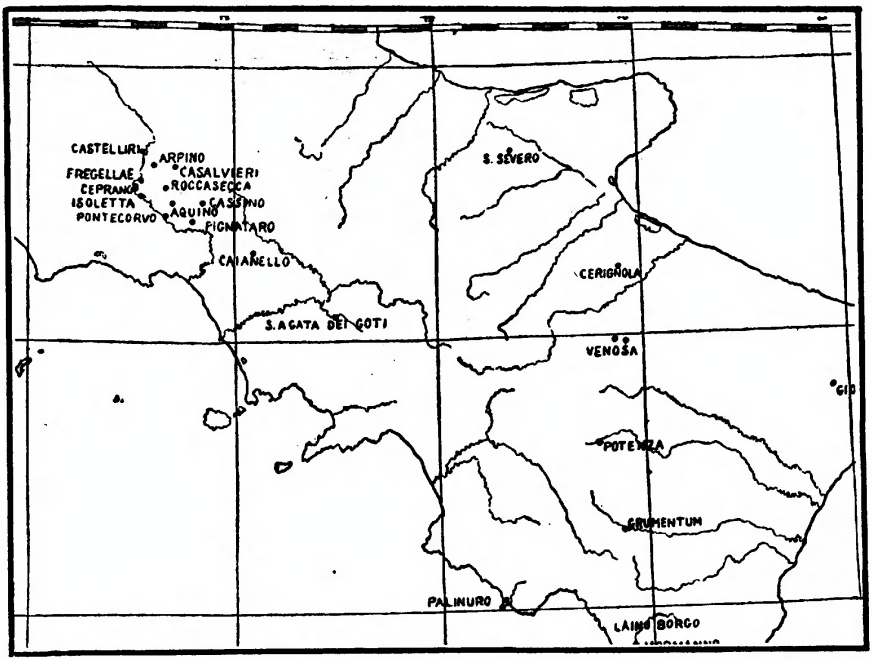
Fig. 2. Pignataro Interamna is near Cassino (circle), southwestern Italy, about fifty miles north of Naples. Region of the Valley of the Liri (Liris) occupied in Pleistocene time by large herds of the 'ancient' or 'straight-tusked' elephant now known as *Palæoloxodon antiquus italicus*, also by *Hippopotamus*, *Cervus*, *Bos*, *Dicerorhinus*, and other species of *3d Interglacial* time. After Pl. 94 of the Century Atlas, edition of 1913.

[1]Kindly prepared by Miss Francesca LaMonte of the Department of Ichthyology of The American Museum of Natural History.

The locality in which the fossil in question was found forms, with the hill of Pignataro Interamna, part of this whole system of gently rolling hills, which extend from Aquino and Pontecorvo along the left bank of the Liri as far as the river Rapido below Cassino, and which are made up of large alluvial deposits of the early quaternary, deposited first among the chain of the Aurunci and that of the Mainarde, later moulded by backwaters, defluents in lesser volume of the present and more confined course of the river Liri, which still today, as in the day of Orazio, continues with its calm waters the taciturn corrosion of its plains.

rura, quae Liris quieta
mordet aqua taciturnus amnis.

The present plains, formed in recent times by the Liri, extend below Pignataro Interamna to about twenty metres above sea level; while the hills mentioned above,



UPPER MIDDLE PLEISTOCENE HORIZON OF PAL. ANTIQUUS ITALICUS

Compare figure 2

Fig. 3. Valley of the Liri River displaying the principal exposures along the eastern and western banks and slopes of the bordering hills, varying from 60 to 70 meters above the present sea level, of a thickness of about 50 meters, where the remains of *Palæoloxodon antiquus italicus*, of *Hippopotamus*, of *Cervus*, and of other Pleistocene animals have been found. Twelve localities in which discoveries by Italian palæontologists of more or less perfect remains of this fauna have been recorded since the first note by Oronzio Costa in June, 1864. After De Lorenzo and D'Erasmo, 1927, p. 7, fig. 1. Upper portion only. Scale 1:3,000,000.

formed by the early quaternary diluvium, vary between 60 and 70 metres, thus giving a thickness of about 50 metres to the uncovered Pleistocene ground. This territory, prevalently clayish in the lower parts, becomes on top sandy,—yellowish sand and gravel interspersed with layers of clay and mud, and, on top, volcanic cinders.

In this early quaternary district some time ago there were already found remains of fossil mammifers, especially elephants. These have been preserved in part in the Museum of Geology and Palæontology of the University of Naples. Oronzio

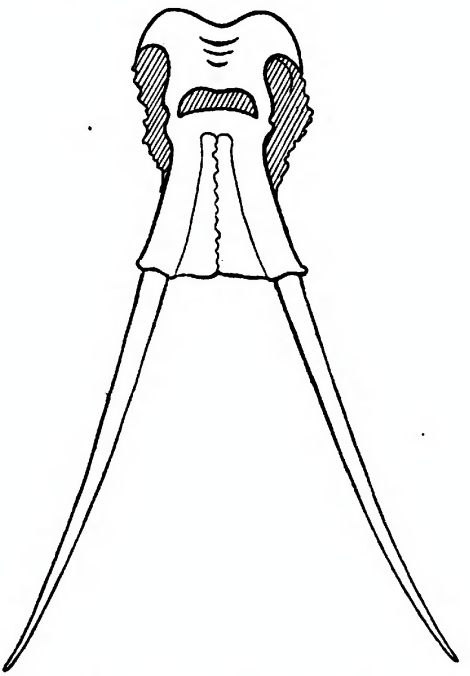


Fig. 4. Front view of the Pignataro Interamna cranium (Amer. Mus. 22634) *in situ*. After De Lorenzo and D'Erasmo, 1927, p. 36, fig. 10: "Cranio dell'*El. antiquus* di Pignataro Interamna, visto di fronte (1/40 della grand. nat.)." Reproduced same size.

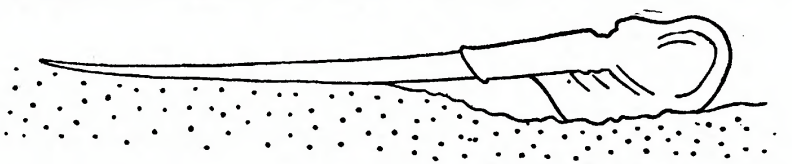


Fig. 5. Cranium of Pignataro Interamna (Amer. Mus. 22634) *in situ*. After De Lorenzo and D'Erasmo, 1927, p. 37, fig. 11: "Cranio dell'*El. antiquus* di Pignataro Interamna, visto di fianco, ancora parzialmente immerso nella sabbia (1/40 della grand. nat.)." Reproduced same size.

Costa first noted them in the Rendiconti della Reale Accademia di Scienze fis. e mat. di Napoli for June, 1864. They were fully described by Giustiniano Nicolucci in his memoir *Su gli elefanti fossili della Valle del Liri* [Concerning the fossil elephants of the Valle del Liri] (Memorie della Soc. ital. delle Scienze, detta dei XL, vol. IV, 1882). Cacciamali contributes further to this in the Bollettino della Società geologica italiana, 1890, describing some molars of the elephants of Val di Comino and of Aquino. Finally, they are mentioned by Antonio Weithofer in his memoir on the fossil Proboscideans of Valdarno (a memoir which serves as the descriptive matter for a geologic atlas of Italy, vol. IV, part 2, Firenze, 1893). Hans Pohlig also speaks of this in his big monograph on *Elephas antiquus*, published in the Nova Acta Academiae Caes. Leopold. Carol. Germanicae naturae curiosorum, vol. 53, Halle, 1889, and vol. 57, Halle, 1892.

My own and the observations of others are gathered together in my 'Geologia e Geografia fisica dell' Italia meridionale,' Bari (Laterza), 1904. On page 157 I spoke of the certain existence of *Elephas* (*Euelephas*) *antiquus* Falc. in the early quaternary deposits of the Valle del Liri.

The fact that remains of fossil elephants already existed in the Valle del Liri does not diminish the importance of the present discoveries at Pignataro Interamna; of really exceptional importance because of the completeness of the exhumed cranium and because of its position, a position which leads to the deduction that it was found in its original posture, not a secondary one caused by transportation, and this leads to the hope that it may be connected with the rest of the animal's skeleton.

The enormous head rests with its longitudinal axis, which measures not less than 3.50 metres from the frontal protuberance to the apex of the tusks, in an almost perfect horizontal position (Pl. 1, figs. 1 and 2) in such a way as to lead one to suppose that the animal, descending to bathe in a muddy and richly vegetated brook, sank in the sand and mud, and, unable to swim, tried to keep its head and proboscis above in order to breathe as long as possible, until it sank altogether, and a lower alluvial deposit than that of its prey covered and surrounded the creature. This hypothesis is strengthened by the fact that in close proximity to the head and interspersed among the yellow gravel is a soft black layer, muddy and agreeing with the herbaceous vegetation of the bottom of the swamp in which the elephant probably sank. For these reasons it is anticipated that probably behind the head, still *in situ*, there is to be discovered all the skeleton of the elephant, which can therefore be dug out, given the opportunity.

But the excavation is not easy, not so much because of the depth as because of the easily shattered nature of the skeleton itself. The bones excavated up to now, that is, those of the head, as well as being petrified are, as it were, decalcified, in such a way that to isolate and gather them, there is need of great delicacy and accuracy. To isolate the mandible and uncover the molars, I myself had to dig a tunnel beneath the cranium, which I later filled in again to prevent slipping of the enormous skull. This decalcification and corrosion of the bones are due, I believe, to the fact that the water, penetrating from the humus into the subsoil loaded with carbonic acid, passed harmlessly through the sand which was prevalently silicious and gradually in the course of thousands of years, dissolved the phosphate and carbonate of the chalk of the skeleton, leaving the bones porous and blackened through the carbonization of the organic substance of the bony parts. The upper molars, for example, are reduced to a series of pockets devoid of enamel, all the dentine and cement having been carried

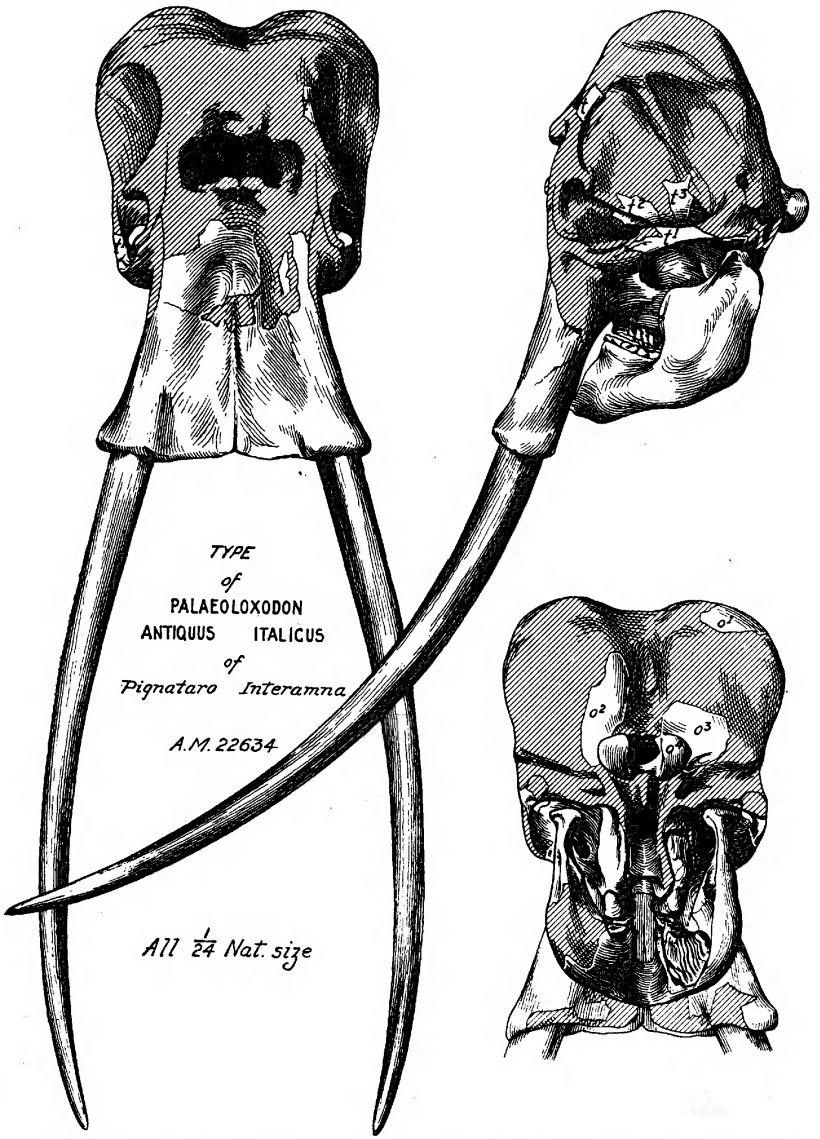


Fig. 6. Type cranium of *Palæoloxodon antiquus italicus* (Amer. Mus. 22634) as reconstructed and mounted in the American Museum during 1929 and 1930. One twenty-fourth natural size. Restored parts (oblique lines); parts preserved (shading), namely, occipital condyles, portions of premaxillaries and maxillaries, and complete mandible.

The measurements, as seen from the front, with but two exceptions accord exactly with those given above by De Lorenzo. The few original fragments seen in frontal aspect lie at the back of the narial chamber (*c*); along the border of the left temporal fossa (*t*), and along the temporal arch (t^1); in lateral aspect of the left side, as shown in the fragments in the left temporal fossa (t^2, t^3) just above the fragment of the right temporal arch (t^1), transferred to the left side for purposes of restoration. In posterior aspect, the occipital parts preserved are portion of the superior border (o^1), and parts of the posterior occipital plate (o^2, o^3) and the very broad condyles (o^4).

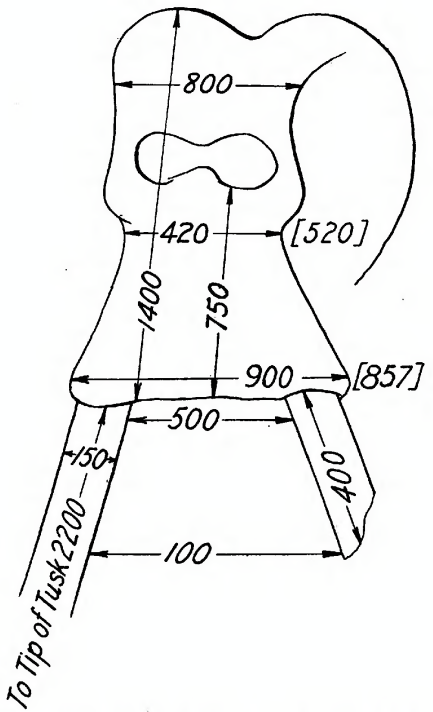


Fig. 7. Diagrammatic sketch, prepared in the American Museum to aid in the eighteen months' process of reconstruction. Cranium of *Palæoloxodon antiquus italicus* (Amer. Mus. 22634), based upon original photographs (Fig. 1), showing the exact measurements recorded in De Lorenzo's contribution of 1926 and fully quoted in his Memoir of 1927. The American Museum reconstruction, completed November, 1930, in front view accords exactly with the 1926–1927 measurements of De Lorenzo, except as to width of rostrum [857 mm., 520 mm.], as follows:

Apex of right tusk to vertex of cranium	3500 mm.	11 ft.	5¾ in.
Vertex of right tusk to border of premaxillary socket	2200	7	2⅝
Lower border of premaxillary socket to vertex of cranium	1400	4	7⅛
Diameter of incisive tusk at exit from socket	150		5⅞
Transverse breadth across premaxillary sockets	900 [857]	2	11⅜ [9¾]
Space between inner sides of incisive tusks.	500	1	7⅝
Transverse space across rostrum just below orbits	420 [520]	1	4½ [8½]
Midline of premaxillary rostrum to midline of nasal opening	750	2	5½
Transverse across narrowest portion of frontals	800	2	7½

away. This hypothesis is further supported by the fact that, while the sand and gravel above the fossil were loose and easily dug up, that below the head contained pieces harder than calcareous tufa, evidently the chalky deposits from the bones.

In this formation and in such conditions now lies the cranium of the elephant, truly imposing in its silent grandeur. From the peak of the cranial protuberance [vertex of cranium] to the distal border of the intermaxillaries it is 1.40 metres long, its width on the frontal line between the parietals is 0.80 metres. Characteristic is the fan-shape of the two intermaxillaries, which together, below the nasal cavity, measure 0.42 metres [520 mm.] wide, while on the anterior border, concave and circular, they widen to 0.90 m. [857 mm.], keeping in the free internal space between the two incisive tusks a width of 0.50 m. and having a total length, along the median suture, of 0.75 m. The two incisive tusks, 0.15 m. in diameter at the exit of the sockets and 2.20 m. long, very beautifully and perfectly formed and gently and elegantly curved both on the inner and outer curves, diverge widely, following the external line of the intermaxillaries in such a way that 0.45 m. from the exit of the sockets they are already a metre apart, and the two apices more than two metres from each other.

The mandible is so closely adherent to the upper maxillary that its symphysis appears to be almost soldered to the internal surface of the intermaxillaries. The symphysis is wide, near the condyles, about 0.60 m., with as much again in measurement on the bisettrice [midline ?]. On detaching the cranium, the plates of the upper molars, devoid, as we have said, of cement, and deprived of support, fell at once. The lower molars of the mandible stayed in place; especially on the right arc of the mandible one can see plainly the traces of the abrasion of the first (or second) molar, 0.10 m. long, 0.07 m. wide, with six residual plates, and the second (or third) molar, 0.17 m. long, 0.07 m. wide, with 10 plates.

All these characters, and especially the length of the cranium, the prominence of the protuberance and of the occipital fossa (see Pl. 1, fig. 1), the enormous divergence of the intermaxillaries and of the incisive tusks (Pl. 1, fig. 2 and interpolated figs. 10 and 11), the frontal depression, the narrowness of the plates of the molars in proportion to their height and to the length of the molars themselves, the form of the *difese* [framework?], show clearly that the cranium from Pignataro Interamna belongs to the species *Elephas* (*Euelephas*) *antiquus* Falconer, characteristic of the interglacial phases of the early quaternary and the largest of the few species of elephants which have inhabited the earth. The fortunate discovery of this complete cranium further shows that, contrary to what Pohlig wrote, Falconer was right in maintaining that his *Elephas antiquus* was closely allied to the living Indian elephant, *Euelephas indicus*.

If the excavations are continued, as it is to be hoped they will be, one will be able later on to issue a more exact and complete description of the magnificent animal of Pignataro Interamna.

The above citation from G. De Lorenzo and G. D'Erasmo (1927), pages 35–39, figures 10 and 11, and plate 1, figures 1 and 2, affords invaluable information as to the Pignataro Interamna cranium in its original undisturbed condition partly buried in the matrix. These drawings and photographs demonstrate the superb condition of the cranium and tusks when first exposed and our knowledge is fortunately amplified by two photographs (reproduced in our Fig. 1) subsequently taken by

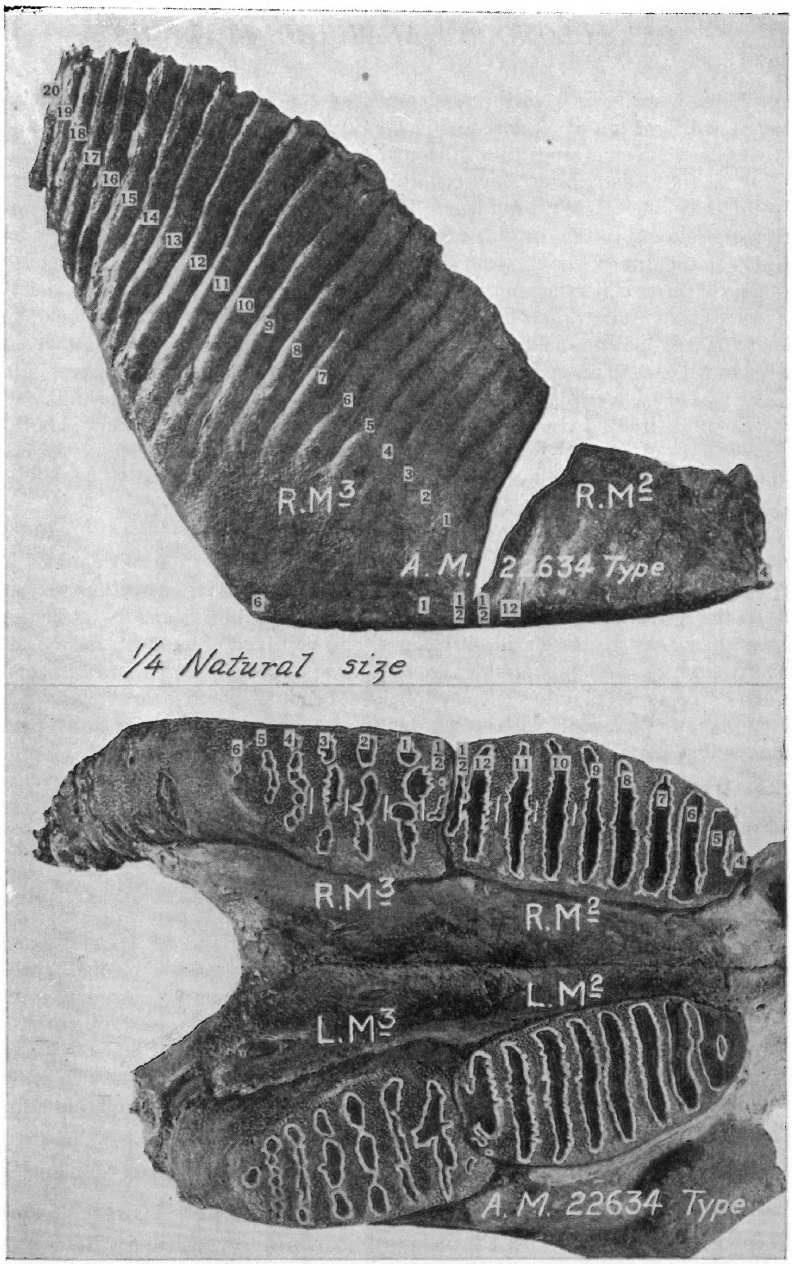


Fig. 8. Type superior grinders of *Pal. antiquus italicus* (Amer. Mus. 22634). One-fourth natural size. After original photographs, retouched and numbered, displaying ridge-plates 1 to 20 in r.M^3, ridge-plates 4 to 12 in r.M^2.

(Upper) Second and third right superior molars, r.M^2, r.M^3.

(Lower) Palate exhibiting right and left superior molars, M^2, M^3.

Saverio Tiseo before he attempted to remove this priceless fossil from its original bed in the matrix. The precise knowledge of the specimen in its original condition afforded by these four photographs, also by the measurements and outline sketches by De Lorenzo reproduced in our figures 4 and 5, is in close accord with the measurements in De Lorenzo's original paper of 1926, pages 187 and 188, as reproduced in our diagram (Fig. 7). Had it not been for these priceless measurements, sketches, and figures, we should find ourselves obliged to record one of the most tragic losses in the history of vertebrate palæontology, namely, the characters of the cranium, jaws, and tusks of an adult *Elephas antiquus* in a perfect condition of preservation.

In the hope that the excavations would be continued and the precious remains would become a part of the collection of the State, Professor De Lorenzo, as Director of the Institute of Geology of the University of Naples, made every effort (1927, p. 39) to secure the specimen for the Naples Museum, but without success.

ACQUISITION BY THE AMERICAN MUSEUM

During the following year (September 4, 1928), the Director of The American Museum of Natural History was informed of the desire of Saverio Tiseo to dispose of the specimen and began negotiations (November, 1928) on condition that no step would be taken without due permission from the authorities of the Italian Government. On December 3, 1928, these terms were formulated in detail, and in May, 1929, the specimen was received in the American Museum.

On opening the boxes containing the fossil, the extremely painful discovery was made that between 1927, when the negotiations of Tiseo with De Lorenzo were concluded, and 1929, the owner Saverio Tiseo had irretrievably damaged the entire upper portion of the cranium by attempting to remove it for purposes of exhibition. Thus the superb and unique cranium shown in Professor De Lorenzo's description and in the figures and photographs above mentioned and reproduced in the present text no longer existed. The remaining parts of the specimen, namely, the rostrum, tusks, palate, jaws, and the lower portion of the occiput were also seriously damaged, while the entire upper portion was irrevocably lost to science with the exception of three small pieces extricated with great difficulty from the hard cement in which Tiseo had attempted to repair the terrible injury which he had inflicted on this priceless specimen. At first the reconstruction of the skull appeared hopeless, and the present author, who had donated it to the American Museum

collection on the basis of the excellent photographs showing the specimen in its original condition, was not even allowed to see it in the laboratory. After eighteen months of arduous labor on the part of Mr. Jeremiah Walsh, under the direction of Mr. Charles Lang, chief preparator, and of Curator Barnum Brown, and finally of Honorary Curator-in-Chief Osborn, the reconstruction entered its final stages in which the precise measurements, figures, and photographs secured by Professor De Lorenzo of the cranium in its original unfractured condition were of incalculable value and importance. Thus, after almost continuous and very expensive labor between May, 1929, and November, 1930, the specimen was ready for complete description and exhibition, although not open to the public until January 1, 1931.

The total cost to the American Museum, including the donation of $1,000.00 by President Osborn, originally estimated at $500.00, mounted step by step to $4,375.34, almost nine times the amount originally set aside for the purpose.

Fig. 9. Type of *Pal. antiquus italicus* (Amer. Mus. 22634). Inner view of third right inferior molar, r.M_3, exhibiting +18+ ridge-plates. One-fourth natural size.

Despite all these financial drawbacks and scientific disappointments, the restored cranium and tusks, jaws, and scapula still afford a wealth of new knowledge regarding the relationships of the classic *Elephas antiquus*, which, added to the equally priceless Upnor skeleton, remove this great branch of the family Elephantidæ from its previous obscurity and uncertainty and enable us to rank it next to *Elephas primigenius* as the best known of the fossil elephants of Eurasia.

Whereas *Palæoloxodon antiquus* belongs in the Lower Pleistocene, or *1st Interglacial*, the present specimen belongs in the upper Middle Pleistocene, or *3d Interglacial;* it is somewhat more progressive than the *Pal. ant. germanicus* of Weimar.

Palæoloxodon antiquus italicus is far superior in size to *Pal. namadicus* and greatly surpasses *Pal. antiquus typicus* both in the number and height of the ridge-plates as well as in the length of the crown. It is a very

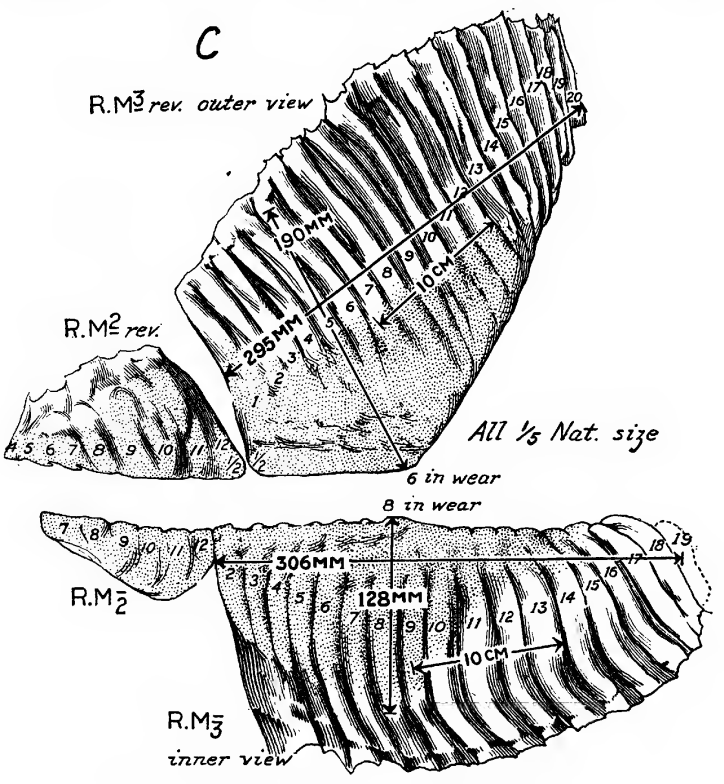
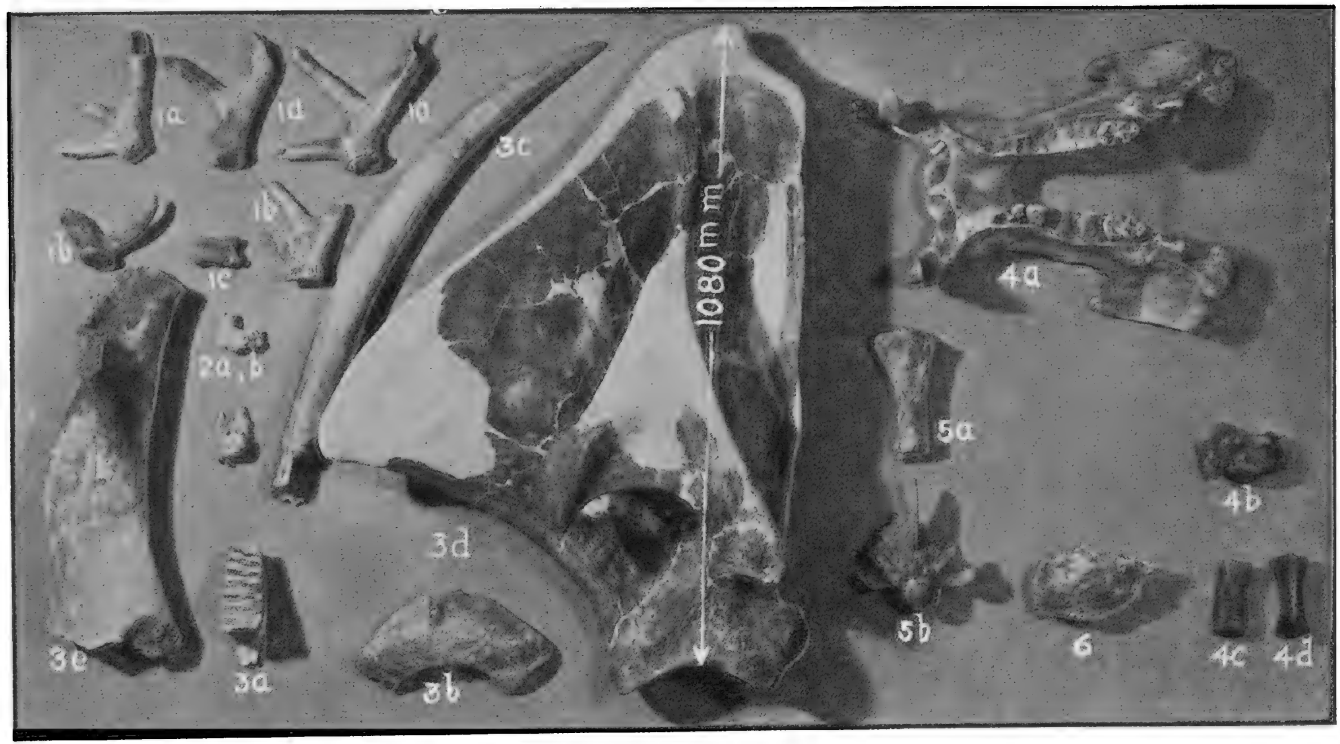


Fig. 10. Type right superior and inferior grinders, M 2, M 3, of *Pal. antiquus italicus* (Amer. Mus. 22634). Diagrammatic key to the superior and inferior ridge-plates:

$$M\ 2\ \tfrac{1}{1}\tfrac{2}{2}\tfrac{1\frac{1}{2}}{}\qquad M\ 3\ \tfrac{2}{1}\tfrac{0}{8}\tfrac{}{+}$$

The principal measurements of r.M^3 are: Length of 20 ridge-plates 295 mm.; height of 5th ridge-plate 190 mm.; 6 ridge-plates in 10 cm. The principal measurements of r.M_3 are: Length 306 mm., height of 8th ridge-plate 128 mm., 4 ridge-plates in 10 cm.



ASSOCIATED MAMMALIAN FOSSILS

About one-thirteenth natural size

Fig. 11. Type right scapula (3*d*) of *Palæoloxodon antiquus italicus.*

(3*a*, *b*, *c*, *e*) Fragment of right second inferior molar (r.M_2), symphysis of mandible, nearly complete female tusk, and central portion of right humerus of *Pal. ant. italicus:* (*d*) right scapula (probably belonging to type).

(4*a*, *b*, *c d*) Mandible, 5th cervical, Mts. IV, juvenile femur of *Hippopotamus amphibius major* ref.

(5*a*, *b*) Right radius and 7th cervical of *Rhinoceros merckii* ref.

(2*a*, *b*) Portion of left inferior molar (M_1) and fragment of mandible of *Bos primigenius.*

(1*a*, *b*, *c*) Portions of three antlers from the left side, two antlers from the right side, also right astragalus of the stag *Cervus elaphus.*

progressive ascending mutation, equaling in size, but exceeding in the number of its superior ridge-plates, the most progressive *Pal. ant. germanicus* of Weimar. However, from close comparison with all the numerous specimens described from Lower Pleistocene deposits in England (by Falconer and others) to *3d Interglacial* deposits in Weimar (by Pohlig and Soergel), *Pal. ant. italicus* appears to be the largest and most progressive member of the '*Elephas antiquus*' phylum thus far discovered.

Fortunately the second and third superior and inferior molars of both sides were preserved *in situ* and their characters are very clearly displayed in the accompanying type figures, in which all the ridge-plates are shown both in crown and lateral view, with clear enumeration of the ridge-plate numbers in figures 8 and 9 and in the diagrammatic figure 10. Very important is figure 8 (lower) in which 15 ridge-plates are shown in simultaneous use, namely, r.M^2, ridge-plates 4 to 12½, plus r.M^3, ridge-plates ½-1 to 6. This stage of attrition represents a young adult male, corresponding with the attrition of *Elephas indicus* estimated to be about forty years of age. To the 20 ridge-plates actually observed in r.M^3 (Fig. 8) there may doubtless be added ridge-plates 21 and 22; whereas in a much older individual of *Pal. ant. typicus* only 16½–17 ridge-plates are shown.

According to recent estimates of Pleistocene time, a 500,000-year interval elapsed between the typical Lower Pleistocene '*Elephas antiquus*' Falconer and the new subspecies herein described, which is even somewhat more progressive than the '*Elephas germanicus*' Pohlig of Taubauch-Weimar.

GEOLOGIC AGE.—The more or less fragmentary mammalian remains found in proximity to the *type* include the following (see Fig. 11):

(1) *Cervus elaphus* Linn.: (a) Three antlers from the left side, (b) two antlers from the right side, and (c) right astragalus. Stag.

(2) *Bos primigenius* Boj.: (a) Portion of left M_1 and (b) fragment of the mandible. Primitive ox.

(3) *Palæoloxodon antiquus italicus* sp. nov.: (a) Fragment of r.M_2, (b) symphysis of mandible, (c) a nearly complete female tusk, (d) right scapula (probably belonging to the *type*), and (e) central portion of a right humerus. Ancient elephant.

(4) *Hippopotamus amphibius* Linn. (Pleist. = *H. major* Cuvier): (a) Complete mandible (Fig. 17), (b) cervical 5, (c) left metatarsal IV, and (d) left femur (juvenile). African hippopotamus.

(5) *Rhinoceros merckii* Kaup: (a) Right radius and (b) cervical 7. Merck's rhinoceros.

(6) Associated with the mammal fauna was the imperfect shell of a freshwater mollusc, referable to the genus *Unio*, of the family Unionidæ.

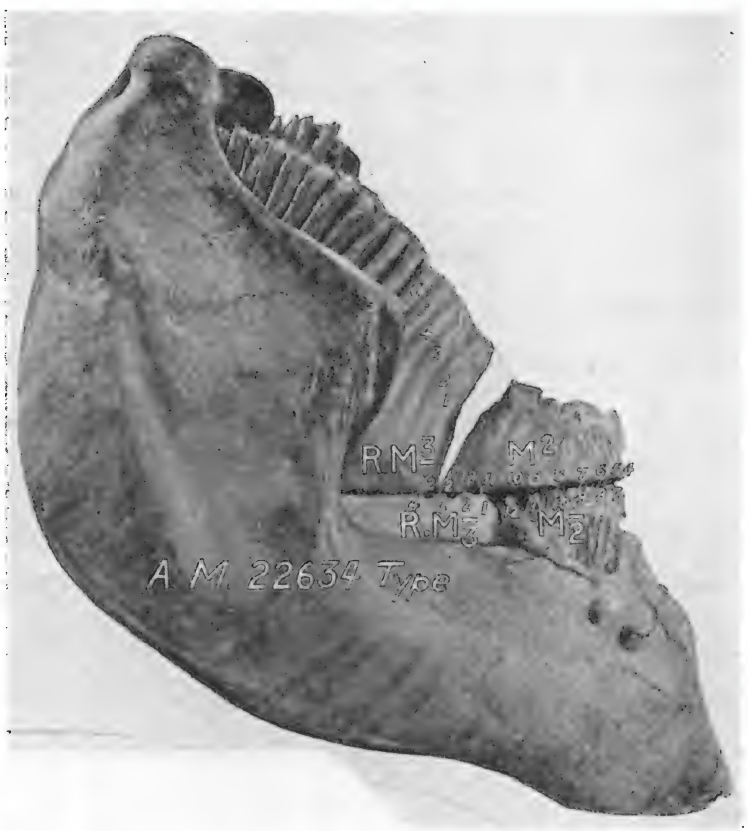


Fig. 12. Type inferior mandible of *Pal. antiquus italicus* (Amer. Mus. 22634). One-sixth natural size. After original photographs, retouched and numbered, showing the ridge-plates so far as exposed to view.

Right lateral view of type jaw with second and third superior teeth, M^2, M^3, superposed on corresponding inferior teeth, M_2, M_3.

Palæoloxodon antiquus italicus, sp. nov.

TYPE.—Amer. Mus. 22634. Cranium and jaws with superior and inferior dentition (M 2–M 3) of a young adult male; also right scapula.

LOCALITY AND HORIZON.—Found in upper Middle Pleistocene river gravels, of *3d Interglacial* time, equivalent to, or slightly more recent in geologic age than, the *3d Interglacial* stage of Taubach-Weimar of the Ilm River valley, Saxe-Weimar, Thuringia, northern Germany, 40 kilometers east and a little south of Burgtonna, north of Gotha, where the first skeleton of '*Elephas antiquus*' (described by Blumenbach as *Elephas primigenius*) was discovered in 1695 (see Chap. XIX of forthcoming Proboscidea Memoir).

SUBSPECIFIC CHARACTERS.—Displayed in the measurements, ridge-plate formulæ, and height of the ridge-plates, enumerated below; also illustrated in the type figures 8, 9, 10, and 12 of the present publication. Progressive evolution indicated as follows:

Pal. ant. typicus; M 3 $\frac{16}{17}\pm$. M^3, length 254 mm., height of tallest ridge-plate 174 mm.; M_3, length 315 mm., height of tallest ridge-plate 126 mm.

Pal. ant. germanicus; M 3 $\frac{17}{18}\pm$. M^3, length 295 mm., height of tallest ridge-plate 190 mm.; M_3, length 425 mm., height of tallest ridge-plate 120 mm.

Pal. ant. italicus (type): M3 $\frac{20}{18}+$. M^3, length 295 mm., height of tallest ridge-plate 190 mm.; M_3, length 306 mm., height of tallest ridge-plate 128 mm.

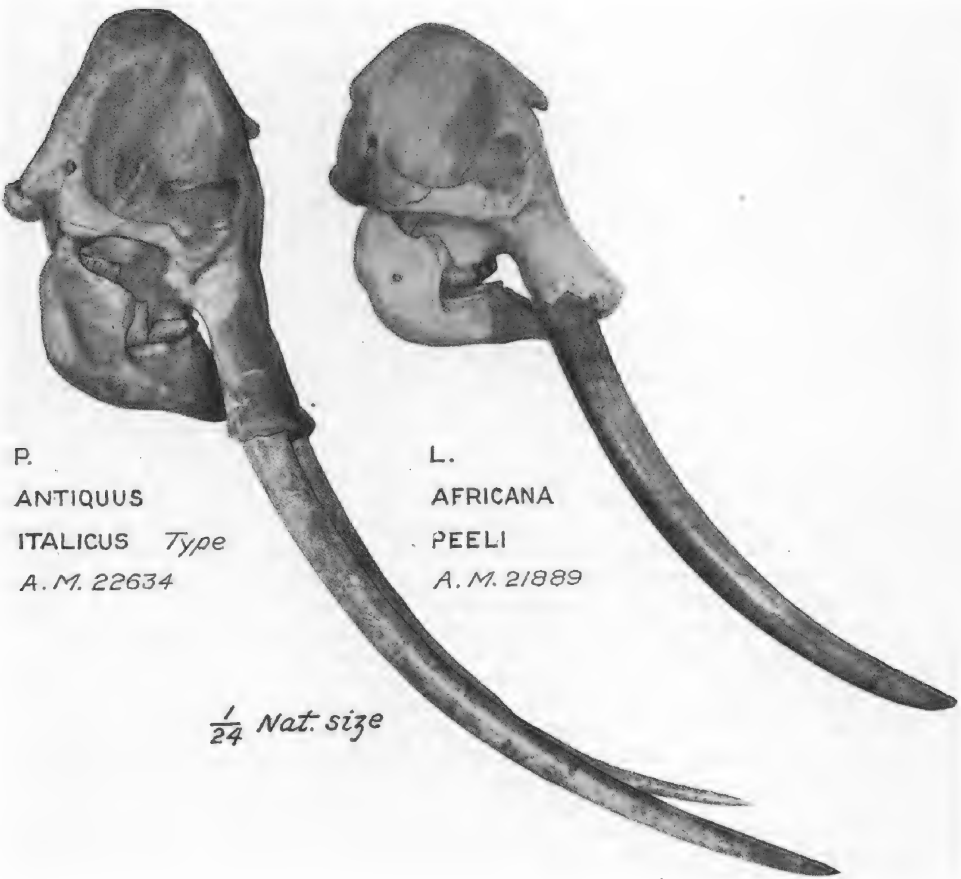
INCISIVE TUSKS.—The incisive tusks of the type are not fully grown (see Figs. 4, 5, 6, 13, 14). Total estimated length 3030–3070 mm., that is, 800e mm. within the alveolus plus 2230–2270 mm. beyond the alveolar border. The longest tusk recorded by Pohlig in the University of Rome collection measures 3900 mm., or 12 ft. 9½ in., in comparison with 10 ft., length of the present specimen. This indicates that a full-grown adult male of *Pal. ant. italicus* attained gigantic size.

LOWER JAWS (FIGS. 6, 12).—The type inferior mandible is entirely complete, as represented in figure 12, requiring little or no restoration. As compared with the more or less complete mandibles figured by Falconer, from the Lower Pleistocene of England, it closely resembles in profile aspect the typical '*Elephas antiquus*' jaw but is very much larger and more massive; it differs widely in every aspect from the mandibles belonging to any species of *Archidiskodon*, *Parelephas*, or *Mammonteus;* the rostrum is abruptly truncated but less abbreviate than in '*Elephas primigenius,*' which is more of the extreme bathycephalic type.

SKULL.—The extremely broad rostrum, characteristic of all stages of the '*Elephas antiquus*' phylum, measuring 857 mm. or 2 ft. 9¾ in., is exactly the same width as that of the '*Elephas platyrhynchus*' of Graells, which measures 860e mm. or about 2 ft. 10 in. transversely; this animal is from the Pleistocene, at San Isidro, near Madrid, Spain.

Most novel and surprising is the dome-like, highly arched occipito-parieto-frontal contour (Figs. 4, 5, 6, 13, 14) which superficially resembles that of the Indian elephant more closely than that of either *Loxodonta africana* or *Palæoloxodon namadicus.* This lofty profile and corresponding bathycephaly are represented correctly in

figures 6 and 13, because they accord exactly with the measurements and photographs taken by De Lorenzo and Saverio Tiseo before this cranium was damaged. Moreover, beside the well preserved and extraordinarily broad occipital condyles (280 mm.), there are portions of the occiput (Fig. 6, o^1, o^2, o^3, o^4) which prove that the occiput is forwardly inclined. The chief comparative measurements between this restored cranium and the cranium of the adult African bull elephant (*Loxodonta africana peeli*—see Fig. 13) are as follows:



CRANIA OF PALÆOLOXODON AND LOXODONTA IN LATERAL VIEW

Photographs reduced to uniform one twenty-fourth scale. Compare figures 6, 14

Fig. 13. (Left) Cranium and tusks of *Palæoloxodon antiquus italicus*, right lateral aspect. Amer. Mus. 22634.

(Right) Cranium of *Loxodonta africana peeli*, adult male, from Mt. Kenia district (Amer. Mus. 21889). See Chapter XIX of forthcoming Proboscidea Memoir.

Comparison with African Elephant	*Loxodonta africana peeli*			*Palæoloxodon antiquus italicus*
(1) From front of orbit to back of occipital condyle	746 mm.		+10%	=820e mm.
(2) From summit of parieto-occipital crest to attritional surface of M^3 (bathycephaly)	800		+24%	=990e
(3) Occipital condyles, transverse	248		+13%	=280
(4) Temporal arches, transverse width across	797		— 6%	=750e
(5) Premaxillary rostrum, maximum width across	665		+29%	=857
(6) Mandibular condyle, height above angle of jaw	489		— 2%	=478
(7) Mandibular length, condyle to apex of rostrum	749		+ 7%	=800
(8) Incisive tusks:	L	R	L	R
total length of	1960e	2010e	3030e	3070e
free length beyond rostrum	1905	1960	2230	2270
maximum diameter at exit from rostrum	156	160	145	139
total circumference of	460	467	433	432

Comparison with L. af. peeli.—In (4) width across temporal arches, *L. africana* exceeds *Pal. ant. italicus* by six per cent. In percentages the cranium of *Pal. ant. italicus* in all other measurements is from seven to twenty-nine per cent. larger than that of *L. africana*, as follows:

(1) Orbit to occipital condyles	10%
(2) Cranial apex to grinding surafce of M^3	24%
(3) Transverse occipital condyles	13%
(5) Width across premaxillary rostrum	29%
(7) Mandibular length	7%

On the average of the five principal measurements, the cranium of *Pal. ant. italicus* is about fifteen per cent. larger than that of *L. africana*. If this fifteen per cent. increase obtains throughout the entire skeleton, the skeletal height of *Pal. ant. italicus* should be about 3673 mm. or 12 ft., as compared with the height *in the flesh* of a large adult bull of *L. africana*, namely, 3450 mm. or 11 ft. 4 in., or with the skeletal height of the *Palæoloxodon antiquus* (*andrewsi?*) of Upnor, from the top of the scapula to the ground, namely, 3700 mm. or 12 ft. 1⅝ in.; thus it appears from the cranial proportions only that the skeleton of *Pal. ant. italicus* was about fifteen per cent. taller at the shoulder than that of the African elephant and closely similar in height to that of the Upnor elephant.

Comparison with Pal. namadicus.—Examined closely, the above measurements prove that the cranium of *Pal. ant. italicus* is profoundly different from that of '*E. namadicus*' (the genotypic species[1] of *Palæoloxodon*) as well as from that of *Loxo-*

[1]Described by Matsumoto (1924) under the subspecific name *Palæoloxodon namadicus naumanni*.

donta africana, which is a relatively primitive cranium. Coördinated with its very tall grinding teeth, the cranium of the Italian specimen is much more bathycephalic (depth 990e mm. as compared with 800 mm. in *L. africana*); it is correspondingly less brachycephalic (750e mm. as compared with 797 mm.); this is in accord with the cranial proportions which are much nearer those of the Indian elephant than of the African elephant. This bathycephaly is, however, a parallelism rather than a point of affinity, because the very broad rostrum of *Pal. ant. italicus* presents an extreme differ-

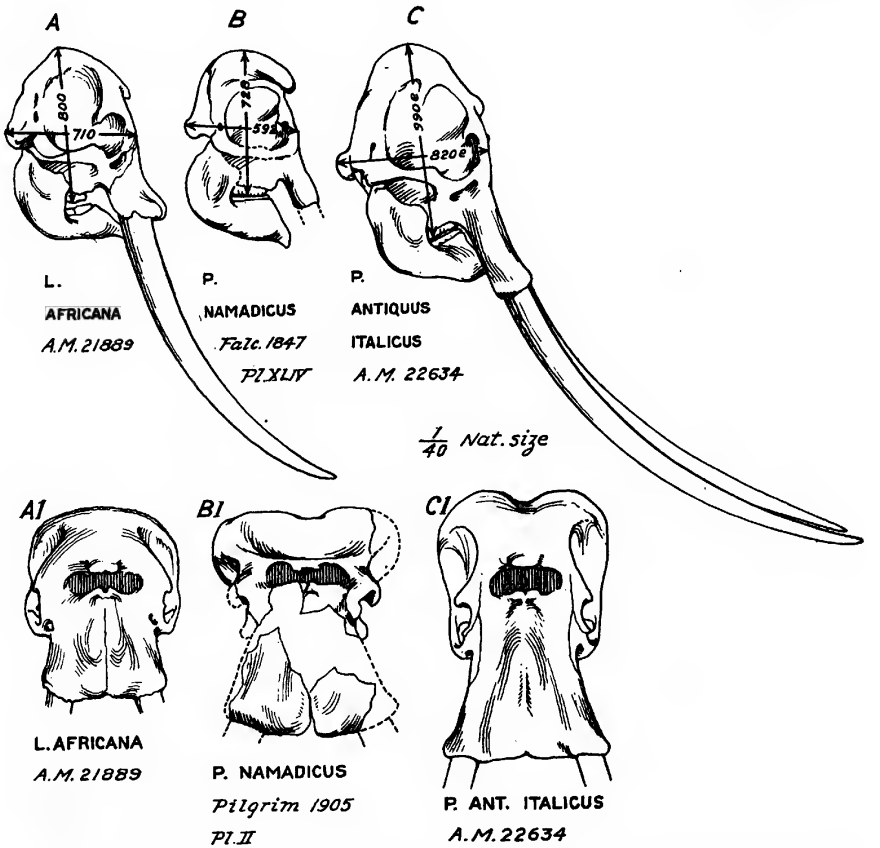


Fig. 14. Comparative front and side views of three adult males. One-fortieth natural size.

A, A1, *Loxodonta africana*. Original.

B, B1, *Palæoloxodon namadicus*. After Falconer and Pilgrim.

C, C1, *Palæoloxodon antiquus italicus*. Original.

Observe as to *bathycephaly* that *P. namadicus* (592 : 728 mm.) about equals *L. africana* (710 : 800 mm.), while *Pal. ant. italicus* is much more bathycephalic (820e : 990e mm.).

ence from the very narrow rostrum of *Elephas indicus*. Comparison with the cranium of '*Elephas namadicus*' shows a strong resemblance in the breadth of the premaxillary rostrum but an extreme difference in the summit of the cranium, which in '*E. namadicus*' is relatively low and reinforced by the overhanging parieto-frontal crest.

This points to *Pal. ant. italicus* as a member of a phylum quite distinct from that of the Siwalik '*E. namadicus*,' a phylum which if supported by other cranial and skeletal differences might well constitute a new genus to which the name HESPERO-LOXODON, or 'loxodont of the west,' might be applied. This name is provisionally proposed, as I would not like to be forestalled a second time, as in the case of *Palæoloxodon*, a generic name assigned to '*E. namadicus naumanni*' by Matsumoto but a few weeks prior to my description of *Sivalikia*.

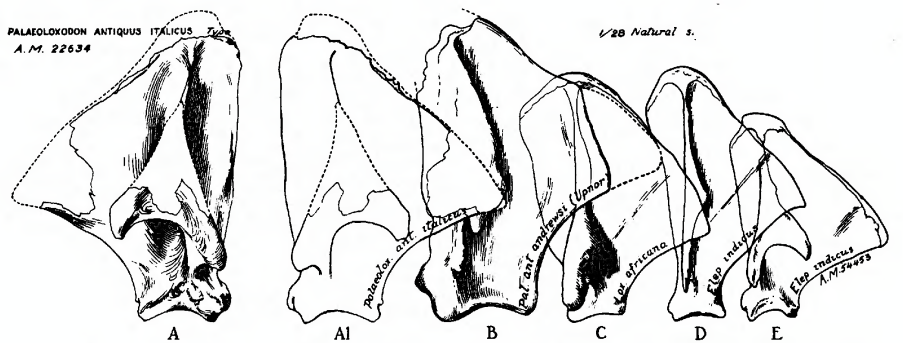
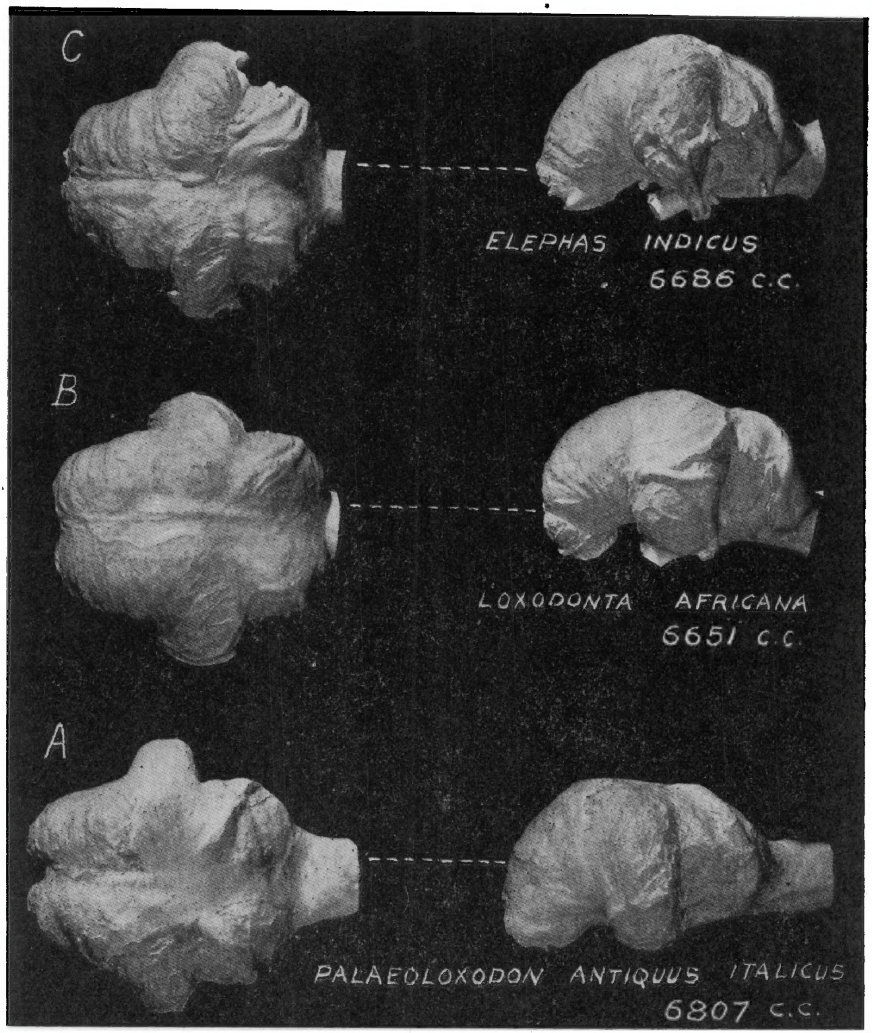


Fig. 15. Right scapula (A, A1 in reversed outline) of the type of *Pal. ant. italicus* (Amer. Mus. 22634) drawn to the same scale as the corresponding scapula of (B) *Pal. ant.* (*andrewsi?*), of (C) *Lox. africana* and of (D) *Elephas indicus*, juvenile (both after Andrews and Cooper, 1928, fig. 2), also of (E) *Elephas indicus*, adult (Amer. Mus. 54453), Vernay's middle-aged male, of which the entire fore limb is shown in Osborn's forthcoming monograph. All figures one twenty-eighth natural size.

SCAPULA.—The right scapula (Fig. 15A, A1) was found near the type and may be considered as belonging to the same individual (Amer. Mus. 22634); it greatly exceeds in size that of the African and Indian elephants of the same age (Fig. 15 C, D, E). On the other hand, it is slightly exceeded in size by the left scapula (Fig. 15B) preserved in the Upnor skeleton. The measurements of the scapulæ of *Pal. ant. italicus* and *Pal. ant.* (*andrewsi?*) are taken with the restored border indicated in dotted lines:

SCAPULA	*Lox. africana oxyotis* (Jumbo)	*Pal. ant. italicus* Pignataro		*Pal. ant.* (*andrewsi?*) Upnor	
Height, superior border (restored) to center of glenoid border	925 mm.	+15%	=1065 mm.	+10%	=1170 mm.
Width, median, across pre- and post-scapular borders	594	+29%	= 770	+12%	= 868e
Anteroposterior diameter of neck of scapula	240	+28%	= 307	+ 6%	= 324
Anteroposterior diameter of glenoid border	187	+35%	= 253	+15%	= 290



INTRACRANIAL CASTS OF PALÆOLOXODON, LOXODONTA, AND ELEPHAS

Fig. 16. Intracranial cast of the Pignataro Interamna specimen compared with casts of the African elephant and the Indian elephant, as exhibited in the American Museum.

	Brain Cube c.c
C) *Elephas indicus*	6686
B) *Loxodonta africana*	6651
A) *Palæoloxodon antiquus italicus* (Amer. Mus. 22634)	6807

ESTIMATES OF SKELETAL AND FLESH HEIGHT.—It is important to compare the estimates of the shoulder height derivable from the scapula as well as from the cranium; they are found to agree exactly, as shown below. Neither the Upnor nor the Italian specimen is full-grown, yet combined they afford a priceless means of estimating the height of the full-grown '*Elephas antiquus.*'

In each of the four above dimensions the scapula of *Pal. ant. italicus* is from fifteen to thirty-five per cent. larger than that of *Lox. africana oxyotis* ("Jumbo," Amer. Mus. Dept. Mam. 3283); the actual skeletal height of "Jumbo" is 10 ft. 5¾ in. or 3194 mm.; consequently if we add fifteen per cent. (the difference in scapular height) to the skeletal height of "Jumbo" we obtain 3673 mm. or 12 ft. ⅝ in. as the estimated skeletal height of the *Pal. ant. italicus* type; this agrees with the height estimated from the proportions of the cranium, namely, about 3673 mm. or 12 ft. ⅝ in.

In height the scapula of *Pal. ant. italicus* is about ten per cent. less than that of *Pal. ant.* (*andrewsi?*) of Upnor, the skeletal height of which is 3700 mm. or 12 ft. 1⅝ in.

Pal. ant. italicus;	
Total skeletal height *estimated* from proportions of cranium	3673 mm. = 12 ft. ⅝ in. ca.
Total skeletal height *estimated* from proportions of scapula	3673 mm. = 12 ft. ⅝ in. ca.
Pal. ant. (*andrewsi?*)	
Total skeletal height *estimated* from proportions of entire fore limb	3700 mm. = 12 ft. 1⅝ in.

To this estimated skeletal height should be added about six and one-third per cent. to obtain the height in the flesh, giving us an estimated height at the shoulder of 3905 mm. or 12 ft. 9¾ in.

Pal. ant. italicus of Pignataro Interamna, adult:	
Estimated height in the flesh	3905 mm. = 12 ft. 9¾ in.
Pal. ant. (*andrewsi?*) of Upnor, young adult:	
Estimated height in the flesh	3934 mm. = 12 ft. 10⅞ in.
Lox. africana, adult:	
Height in the flesh.	3450 mm. = 11 ft. 3⅞ in.

The Pignataro Interamna specimen is several years older than the Upnor specimen, as indicated by the fact that the posterior ridge-plates of the second molar and the anterior ridge-plates of the third molar (Fig. 8) are in use, while in the Upnor specimen the ridge-plates of the second molar only are in use. Comparison with the growth of the large African elephant "Khartum" in the New York Zoological Park shows that in captive conditions at the age of twenty-seven years the animal grows three-quarters of an inch a year. By such an estimate the Pignataro Interamna adult is about five years older than the Upnor

young adult; had it continued to increase in height, the fully adult bulls would measure about 13 ft. 6 in. in height, or two feet above the shoulder height of a large fully adult African bull elephant.

A more complete comparison of the Pignataro Interamna type with the types of Upnor, Kent, England, of San Isidro, Spain, and of north Germany will appear in the author's forthcoming monograph, in which full acknowledgments will be made of all the great contributions to our knowledge of the 'straight-tusked' elephant of Europe since the time of Hugh Falconer.

NOTE.—Shortly after the above description with its illustrations went to press, a separate of the extremely valuable and interesting article "*Der Waldelefant*" *von Steinheim an der Murr* (November, 1930) by Dr. F. Berckhemer reached the Osborn Library. This admirable description of the cranium of '*Elephas antiquus*' came too late for reference in the present article but fortunately not too late for inclusion in the author's forthcoming monograph on the Proboscidea, in which it is planned to treat the Italian and German crania side by side. Palæontology is certainly indebted to Doctor Berckhemer of the Württemberg Society of Naturalists for this most welcome addition to our knowledge.

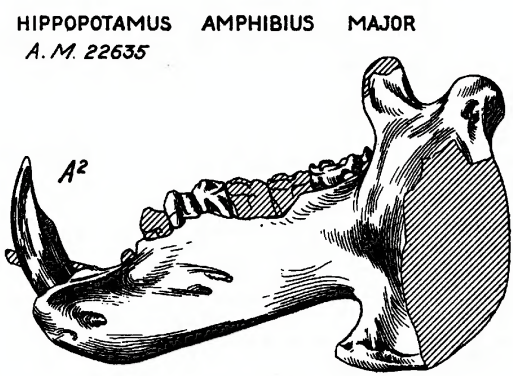


Fig. 17. Full-grown jaw of *Hippopotamus amphibius major* found in the gravels near the cranium and scapula of *Pal. ant. italicus*. Authorities differ as to whether the fossil *H. major* Cuv. is distinct from the living *H. amphibius* Linn.; accordingly *major* may be affixed as a subspecific term distinguishing the fossil species from the recent.